CLAIMS

1. An oil storage assembly for a semi-submersible oil production vessel comprising a deck structure, at least two underwater pontoons for providing buoyancy to said deck structure, and a plurality of columns connecting said deck structure to said pontoons, characterised in that a concrete tank is attached below said pontoons, said concrete tank being subdivided into a plurality of chambers for storing fluid.

2. An oil storage assembly according to claim 1, wherein the tank is subdivided into a plurality of vertical chambers which form a matrix cross the tank, at least one of said chambers being open at the top and bottom so as to provide a through opening in the tank through which oil production operates can be carried out.

3. An oil storage assembly according to claim 2, wherein the tank is subdivided by means of a plurality of fluid tight bulkheads.

4. An oil storage assembly according to any of claims 1 to 3, wherein at least some of the chambers of the tank include a first inlet/outlet conduit located proximate to the bottom of the chamber and a second inlet/outlet conduit located within substantially the upper 20% of the chamber.

5. An oil storage assembly according to claim 4, wherein a first plurality of said at least some chambers are arranged in a cascade arrangement with the second inlet/outlet conduit of one of said plurality of chambers connecting to the first inlet/outlet conduit of the next chamber in the cascade.

6. An oil storage assembly according to claim 5, wherein the first inlet/outlet conduit of the first chamber in the cascade connects to an oil pipe and the second inlet/outlet conduit of the last chamber in the cascade connects to a gas pipe.

7. An oil storage assembly according to any of claims 4 to 6, wherein a second plurality of said chambers have their first inlet/outlet conduit connected to a fluid supply pipe and their second inlet/outlet conduit connected to an oil pipe, fluid being stored in said second plurality of chambers using an oil over a suitable fluid scheme.

8. An oil storage assembly according to claim 7, wherein the fraction of said at least some chambers which form said second plurality is substantially equal to the ratio of the density of oil to the density of the fluid over which it is stored in said second plurality of chambers, and the fraction of said at least some chambers which forms said first plurality of chambers is substantially equal to 1 minus the proportion which form said second plurality.

9. An oil storage assembly according to claim 7 or claim 8, wherein oil is stored over water in said second plurality of chambers, said first plurality of chambers constituting 20% and said second plurality of chambers 80% of said at least some chambers.

10. An oil storage assembly according to any of claims 4 to 9, wherein said second inlet/outlet conduit is located substantially at the top of each said chamber.

11. An oil storage assembly according to claim 4, said second inlet/outlet conduit is located at a distance from the top of the chamber substantially equal to one fifth of the height of the chamber.

12. An oil storage assembly according to claim 11, wherein each of said at least some chambers includes a third inlet/outlet conduit located substantially at the top of the chamber.

13. An oil storage assembly according to claim 12, wherein said first inlet/outlet

conduit connects to a water pipe, said second inlet/outlet conduit to an oil pipe and said third inlet/outlet conduit to a gas pipe.

14. An oil storage assembly according to any of claims 4 to 13, wherein each said first inlet/outlet conduit has a diffuser assembly provided on its end so as to minimise the mixing of fluids within each chamber.

15. An oil storage assembly according to any of the preceding claims, wherein the tank is constructed of varying density materials such that the centre of gravity of the tank and its contents is always lower than its centre of buoyancy, thereby causing an increase in the metacentric height of the assembly.

16. An oil storage assembly according to any of the preceding claims, wherein the volume of the tank is such that when it is at least partially empty, its buoyancy is sufficient to maintain the production vessel at an elevation relative to the water at which the upper surface of the tank is above the waterline.

17. An oil storage assembly according to any of the preceding claims, further including an atmospherically vented break tank located inside the vessel at an elevation below the operating water level by means of which the internal pressure within the tank is maintained lower than the external pressure.

18. An oil storage assembly according to claim 17, wherein one break tank is located inside a column of the vessel.

19. An oil storage assembly according to claim 17 or 18, wherein the fluid level in the break tank is controllable by a level controller which activates seawater ballast pumps to remove water and activates a control valve to allow addition of sea water from the ocean.

20. An oil storage assembly according to any of the preceding claims, wherein a pump is provided to discharge oil to a tanker, said pump being located inside one of said columns above the tank elevation.

21. An oil storage assembly according to any of the preceding claims, wherein the tank is constructed of reinforced and/or prestressed concrete.

22. A semi-submersible, floating production, storage and offloading system for the development of offshore oil and gas fields comprising a drilling vessel, an oil storage assembly according to any of the preceding claims attached to the base of the drilling vessel, means for utilising the drilling vessel's ballast pumps to add or remove water from the bottom of each chamber of the tank and means for directing produced oil into or out of the top of each chamber.

23. A method of storing oil in an offshore floating oil production facility comprising the steps of attaching to the bottom of a pontoon structure a concrete tank, which is subdivided into a plurality of chambers, filling said chambers with at least one fluid to adjust the buoyancy of the production facility, and displacing said fluid from said chambers by pumping produced oil thereinto in a controlled fashion such that the mass of the tank and its contents is maintained substantially constant.

24. A method according to claim 23, comprising the further steps of adjusting the buoyancy of the facility by filing a first plurality of said chambers with a first fluid and a second plurality of said chambers with a second fluid, pumping a first proportion of produced oil into said first plurality of chambers so as to displace said first fluid therefrom, and pumping a second proportion of said produced oil into said second plurality of chambers so as to displace said second fluid therefrom, said first and second proportions being calculated based on the relative densities of the

produced oil and said first and second fluids so as to maintain a substantially constant mass of fluid in said tank.

25. A method according to claim 24, comprising the further step of emptying oil from said tank by pumping said first fluid back into said first plurality of chambers and pumping said second fluid back into said second plurality of chambers in relative amounts such that said first proportion of oil is displaced from said first plurality of chambers and said second proportion of oil is displaced from said second plurality of chambers, wherein the mass of the tank and its contents is maintained substantially constant during off-loading of the produced oil.

26. A method according to claim 24 or claim 25, wherein said first fluid is water and said second fluid is gas, said first plurality of chambers constituting substantially 80% of the volume of the tank and receiving substantially 80% of the produced oil, and said second plurality of chambers constituting substantially 20% of the volume of the tank and receiving substantially 20% of the produced oil.

27. A method according to any of claims 24 to 26, comprising the further steps of connecting said second plurality of chambers in a cascade fashion such that fluid displaced from one chamber enters the next chamber in the cascade.

28. A method according to claim 23, comprising the further steps providing a water inlet/outlet conduit substantially at the bottom of each chamber, providing a gas inlet/outlet conduit substantially at the top of each chamber, and providing an oil inlet/outlet conduit substantially 1/5 of the height of the chamber from the top, filling each chamber of said tank with a mixture of water and gas in order to adjust the buoyancy of the facility, pumping produced oil into each chamber by means of said oil conduit to displace said water and gas so as to maintain each chamber full of fluid and thereby minimise the free liquid surface therein, and controlling the relative

proportions of water and gas displaced from said chamber by said oil in order to maintain the total mass of the tank and its contents substantially constant.

29. A method according to claim 28, wherein oil is off-loaded from the tank by pumping water and gas back into each chamber in relative proportions such that the total mass of the tank and its contents remains substantially constant.

30. A method according to claim 28 or claim 29, wherein said proportions in which said water and said gas are displaced from and/or pumped into each chamber are 80% water and 20% gas.

31. A method according to any of claims 23 to 30, comprising the further steps of at least partially filling each chamber of said tank with gas so as to reduce the total mass of said tank including its contents and hence reducing its draught so as to facilitate maintenance.